

Status of an urban feral Red-Eared Slider (*Trachemys scripta elegans*) population in Sydney a decade on

James Robey¹, Shelley Burgin^{1,3}, Dennis John Hitchen¹ and Geoffrey Ross²

¹ School of Natural Sciences, University of Western Sydney, Locked Bag 1797, South Penrith Distribution Centre, Australia, 1797.

² Geoffrey Ross, Protected Areas Policy and Programs Branch and Wildlife Group, Department of Environment Climate Change and Water, P.O. Box 1967, Hurstville, 1481.

³ Corresponding author: Professor Shelley Burgin, School of Natural Sciences, University of Western Sydney, Locked Bag 1797, South Penrith Distribution Centre, Australia, 1797.

Phone: +61 2 45 701 209 Fax: +61 2 45 701 403

Email: s.burgin@uws.edu.au

ABSTRACT

Introduced species have made a major contribution to the degradation of aquatic wetlands throughout the world and particularly in Australia. One species, Red-Eared Slider *Trachemys scripta elegans*, classified among the world's top 100 most invasive pest species, has established populations in Australia, most extensively in South-eastern Queensland. A decade ago a small established population was identified in a wetland in Southern Sydney in Yeramba Lagoon. We re-visited this population a decade on to determine its status and the impact on the two resident native freshwater turtle species, *Chelodina longicollis* Eastern Long Necked Turtle and *Emydura macquarii dharuk* Sydney Basin Turtle. We captured similar numbers of red-eared sliders as a decade before but increased number of the two native species. There was therefore no indication that the feral species was currently at a competitive advantage over the native species.

Key words: aquatic vertebrate pest, urban wetlands, invasive aquatic species, Australian freshwater turtle, tortoise, Sydney Basin Turtle, *Emydura macquarii dharuk*, *Chelodina longicollis*

Introduction

The loss of biodiversity worldwide has been widely attributed to the impact of exotic species (Mooney and Cleland 2001; Cox 2004; Gong *et al.* 2009). As a consequence there are a range of introduced species that are expanding into ecological communities with low resilience to external pressures and many endemic species have suffered significant decline as a result (Beeton *et al.* 2006).

With the exotic flora and fauna trade increasing globally, it is estimated that approximately 20 new pests and/or diseases are introduced into Australia annually (CSIRO 2004). Recent estimates indicate that the result of introduced vertebrate pest species alone costs Australian agriculture approximately AUD\$743.5 million per annum (Gong *et al.* 2009). The cost to native species and their habitats due to degradation, predation, competition, introduced disease, and species displacement is immeasurable. The native biota of Australian inland waters has been particularly severely affected by introduced flora and fish species (DEC 2006). Some of these exotic pest species, such as European Carp *Cyprinus carpio* and Mosquito Fish *Gambusia holbrooki*, continue to expand their range and broaden their impact on native species and their habitats. For example, in the Lower Murray – Darling catchment exotic species make up 56% of the total fish biomass, and competition from introduced species (e.g., European Carp) has resulted in the widespread decline of native species populations (Gilligan 2005).

An emerging pest species in Australia, initially introduced for the aquarium trade, *Trachemys scripta elegans* Red-Eared Slider turtle has subsequently 'escaped' into Australian freshwater ecosystems. This species has the potential to have a major impact on native species (Burgin 2006, 2007), and is of particular concern because its native range in North America mirrors Australian clines (e.g., Rose and Manning 1996; Painter and Christman 2000; Burgin 2006, 2007), and it has been classified by the IUCN/SSC Invasive Species Specialist Group as one of the 100 most invasive pest species in the world (IUCN/SSC 2009). The species is already well established in South-eastern Queensland, with additional confirmed reports from throughout much of mainland Australia, often in association with large urban areas (see e.g., Burgin 2007). For example, Red-Eared Sliders have been reported from across the Sydney region, and a small breeding population was identified in late 1996 - early 1997 in Yeramba Lagoon, Southern Sydney (Burgin 2006). In 2008 (approximately a decade later) the wetland was re-sampled to determine the current status of the Red-Eared Slider population in that wetland, and to determine if there had been an impact on the native species due to this introduced species. In this paper we review the status of turtles in Yeramba Lagoon, a decade after the feral population was identified as resident in the wetland.

Methods

Site Description

Yeramba Lagoon is a large freshwater lagoon located in Southern Sydney (33°58'40S 151°00'09E). With an approximate surface area of 5.97 ha, it was originally a tidally-induced natural lagoon associated with the Georges River. In 1964, the lagoon was separated from the main river system by causeway construction, and there was no longer a tidal influence. Fresh water from the catchment pooling behind the causeway formed a freshwater wetland, Yeramba Lagoon (Eco Logical Australia 2003).

Located in a highly urbanised catchment, the surrounding native vegetation communities of Yeramba Lagoon have been invaded by weeds. Due to the catchment's urban gardens, high concentrations of nutrients enter the Lagoon in runoff and foster aquatic weed growth (e.g., *Alternanthera philoxeroides* Alligator Weed, *Eichhornia crassipes* Water Hyacinth, *Salvinia molesta* salvinia; NPWS 1994). The lagoon has a variety of associated native fauna, including 80 bird species, 13 reptile species, eight amphibian, and five mammal species (Eco Logical Australia 2003).

Trapping

Turtles were surveyed on 28 days between April and September, 2008. On each sampling occasion two fyke (Eel) nets (Net and Tackle, Prymont) were baited with pilchards and bread, and the nets were positioned perpendicular to the bank. Floats were placed in the nets to ensure that captured turtles could breathe at the water's surface.

When retrieved from the nets, turtles were identified, sexed, and the curved carapace length was recorded. Native turtles were released at point of capture. Captured Red-Eared Sliders were taken to the Taronga Zoo Veterinary and Quarantine Centre to be euthanised. To determine if there were differences in turtle numbers between 1996 – 1997 and 2008, the data sets were standardised (because sampling was over a longer duration in 2008 compared to the earlier sampling) using 12 sampling days x 12 traps/day as the standard (sampling effort of earlier study). Chi square analysis was undertaken to compare population structure over the period.

In parallel with the fyke net sampling, turtles were also captured in cathedral traps (Northside Nets and Repairs, Toorbul), and comment is made on these data as deemed appropriate.

Results

Overall a total of 199 freshwater turtles (146 *Chelodina longicollis*, 49 *Emydura macquarii dharuk*, four *Trachemys scripta elegans* and no *Clemmys marmorata*) were captured in the seven month trapping period. Of these 69 turtles were captured in fyke nets. The mean carapace length of *C. longicollis* was 171.02 ± 4.76 mm (range 100-210 mm), *E. m. dharuk* was 155.49 ± 4.56 mm (range 130-230 mm), and *T. s. elegans* was 207.5 ± 5.75 mm (range 170-240 mm).

Compared to the 1996 – 1997 data where 49 individuals were captured in 12 fyke nets over 12 days of sampling, there was a significant difference in the number of turtles captured ($\chi^2_{2, <0.0001} = 43.408$) in 2008. There was an increase in the number of native species, particularly *E. m. dharuk*. In both sampling periods the numbers of *T. s. elegans* was low in comparison to native species (Figure 1). All introduced turtles captured in 2008 were male and *T. s. elegans*.

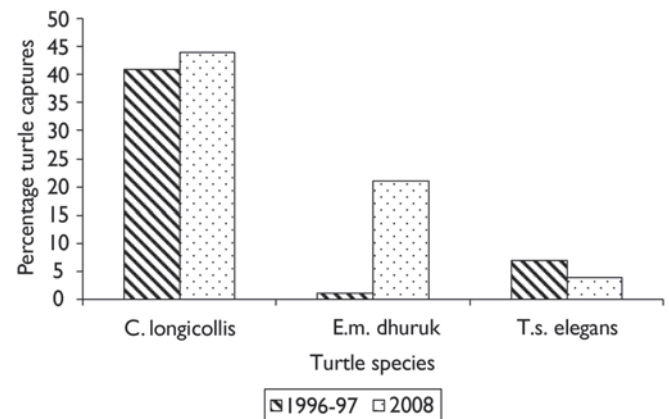


Figure 1. Number of freshwater turtle captures (standardised and presented as percentage of total catch) in fyke nets in Yeramba Lagoon, Southern Sydney in 1996-1997 compared to 2008.

Discussion

More native turtles were captured in 2008 than in the initial survey a decade before, and numbers of introduced species remained in low. This is in contrast to the observations from South-eastern Queensland where the species is well established north of Brisbane (O'Keeffe 2005), and in some areas they appear to have displaced all local native species (O'Keeffe pers. com.). There is also widespread evidence that Red-Eared Sliders have become established pests outside of their natural range on every continent except Antarctica (Salzberg 2000), and on many islands (Ramsay et al. 2007) elsewhere (e.g., Guam - McCoid 1993; New Zealand, Fieldman - 2005; Singapore - Ng et al. 1993; Japan - <http://homepage3.nifty.com/japrep/englishtop.htm>; Taiwan - Chen and Lue 1998). Population size may vary between apparently relatively small populations (e.g., Cadi et al. 2004; Burgin 2006) to large populations that cover an extensive area. For example, in a review of 'Turtles of Borneo and Peninsular Malaysia' by Liat and Das, Levell (2000) suggested that the introduced Red-Eared Slider was 'almost universally' present in the region. In contrast, Cadi et al. (2004) reported that although they were found in many regions of Europe, large established breeding populations were restricted to areas of Southern Europe (e.g., France, Spain).

Based on the observation that Sliders appear to flourish in sub-tropical/tropical areas, for example in South-east Asia (Levell, 2000), Europe (Cadi et al. 2004), and Australia (O'Keeffe 2005) compared to more temperate areas in Europe (Cadi et al. 2004) and Australia (Burgin 2007) it may be tempting to attribute climatic conditions to the

maintenance of a small population size in Yeramba Lagoon. However the distribution of the species within its natural range in North America belies this explanation. The species' native range includes areas that are substantially colder and drier than Sydney. There is therefore no evidence that the species is being kept in check because of climatic conditions (see e.g., <http://bss.sfsu.edu/holzman/courses/Fall01%20projects/reslidermap.jpg.JPG>).

Since Burgin (2006) trapped only female (most gravid), and in 2008 only males were captured, the techniques used to net these turtles therefore requires consideration. In 2008, in addition to the 2 fyke nets, 10 baited cathedral traps were also set in deeper water within the Lagoon. Although native turtles, *E. m. dharuk* and *C. longicollis*, were captured in these nets in broadly similar proportions as in the fyke nets, no Sliders entered the cathedral traps (Robey 2008). We therefore assume that the sex-biased sample, at least in 2008, was not a result of the use of inappropriate nets. Removal of females in the original sampling may have had an impact on the founder population although with an estimated population of between 17 to 42 females in the wetland a decade ago (Burgin 2006), we consider it unlikely that the removal of seven *T. s. elegans* and one *C. marmorata* would provide an explanation for the apparent lack of feral female turtles in 2008.

The differences presumably reflect the timing of sampling. Burgin (2006) sampled between October and March (encompassing breeding season, Thomas et al. 1999) whereas we sampled between April and September. Male and female *Trachemys* spp. have different reproductive strategies. Males seek to optimise their reproductive success with peak mate-searching activity in early spring and late autumn. Female activity is matched or exceeded only in Spring (Moreale et al. 1984; Gibbons 1990). We propose that the apparent lack of females among our samples, and

the lack of males in previous study (Burgin 2006), is due to differences in timing of sampling which, in turn, reflected differences in activity patterns between gender.

One factor that is undoubtedly impacting on recruitment to the population is predation by foxes. Burgin (2006) observed nests were destroyed by foxes at Yeramba Lagoon while Thompson (1983) estimated that approximately 93% of eggs laid by native turtles were taken by foxes in the South Australian reaches of the Murray River. In urban areas domestic animals presumably also play a role in predation and such pressure would inhibit recruitment to the Yeramba Lagoon population. However we expect that such predation pressure would have an equivalent impact on the native turtles species since they tend to nest in the same general area as the feral species (Burgin, 2006).

Conclusion

Burgin (2006) concluded that there was a breeding population of Red-Eared Sliders in Yeramba Lagoon, although no males were collected. We have now confirmed that there are adult males present. This reinforces the proposition that there is a breeding population present in the Lagoon, however because of the biased samples (i.e., all males in 2008, all females a decade earlier) there is clearly an issue with collecting an accurate sample of the population. Despite this issue, it appears that the population has remained low relative to the native turtle populations, and the presence of the feral population apparently has not had an impact on native species' numbers. However because the mechanisms involved in keeping this population of Sliders in check remain elusive, it is unwise to make any prediction of the future trends in the feral species population in Yeramba Lagoon. This finding will continue to complicate decisions associated with management of this feral species within the Sydney region.

Acknowledgements

This project was funded by a grant from the Department of Climate Change, Environment and Water, directly

from National Parks and Wildlife Service and the Environmental Trust Grants.

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